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प्रत्यागामी गैस संमीडक — तकनीकी पूर्ति शर्तें

Indian Standard

RECIPROCATING GAS COMPRESSORS — TECHNICAL SUPPLY CONDITIONS

UDC 621·512 : 006·87

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Price Group 13

Compressors, Blowers and Exhausters Sectional Committee, HMD 22

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Compressors, Blowers and Exhausters Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

The standard covers the compressors for booster and vacuum applications and shall be of cross head type, lubricated or non-lubricated construction. However, it excludes the hermatically sealed type air conditioning/refrigeration compressors (not industrial type), piston type and high speed separable natural gas compressors.

In the preparation of this standard, assistance has been derived from ISO 8012-1988 'Compressors for the process industry — Reciprocating types — Specifications and data sheets for their design and construction' and API 618-1986 'Reciprocating compressors for general refinery purposes'.

Indian Standard

RECIPROCATING GAS COMPRESSORS — TECHNICAL SUPPLY CONDITIONS

1 SCOPE

1.0 This standard covers the technical supply conditions of reciprocating gas compressors.

1.1 This includes compressors for boosters and vacuum applications and shall be of cross-head type, lubricated or non-lubricated construction.

1.2 This excludes hermetically sealed type airconditioning / refrigeration compressors (non-industrial type), trunk piston type aircooled and high speed separable natural gas compressors.

2 RERERENCES

The Indian standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.0 For the purpose of this standard, the terms and definitions as laid down in IS 5727 : 1981 and the following shall apply.

3.1 Adiabatic Discharge Temperature

It is the discharge temperature theoretically calculated assuming the adiabatic compression cycles.

3.2 Rated Speed

It is the speed at which the compressor is to run to meet with the specified service conditions.

3.3 Maximum/Minimum Allowable Speed

The maximum/minimum allowable speed at which the compressor can be run.

3.4 Rated Horsepower at Operating Conditions

It is the horsepower of the compressor at the operating conditions. It is the maximum power of the compressor plus any shaft driven appurtenances required for any of the specified operating conditions. The rated power includes the effect of any equipment (such as pulsation, suppression device, process piping, inter-cooler, after cooler and separator) suggested by the compressor purchaser. Driver losses are stated separately.

3.5 Rod Load Reversal

It is the change in the direction of piston rod loads (tension to compression or vice-versa), which ultimately causes rod reversal at the cross head pin during each revolution.

3.6 Manufacturer

The party manufacturing the machines. The manufacturer may or may not be a supplier.

3.7 Purchaser

The party purchasing the machine. The purchaser shall also cover the person or persons authorised in writing by the purchaser to act on his behalf.

3.8 Supplier

The party supplying the machine. The supplier may or may not be a manufacturer of the machine. The term 'Supplier' shall also cover any party with whom the supplier places an order for partial compliance.

4 MATERIAL OF CONSTRUCTION

It is recognized that a number of materials of construction are available to meet the needs of compressors. A few typical materials are listed below for guidance of manufacturers and users.

Sl No.	*Component*	*Material*	*Minimum Grade*
1	Frame	Cast iron	FG-260 IS 210 : 1978
2	Crankshaft	Steel	40C10S18 of IS 4431 : 1978
		Spheroidal grey iron	Gr SG 600/3 IS 1865 : 1991
3	Crosshead	Cast iron	FG 260 IS 210 : 1978
		Spheroidal grey iron	SG 600/3 IS 1865 : 1991
		Aluminium	Alloy 8482 IS 6754 : 1972
4	Connecting rod	Steel	45C8 IS 5517 : 1978 Class 3 IS 1875 : 1992
5	Crosshead pin	Steel	Class 1 1875 : 1992
6	Distance Piece	Cast iron	FG 260 IS 210 : 1978
7	Cylinders	Cast iron	do
		Spheroidal grey iron	SG 600/3 IS 1865 : 1991
		steel	620 IS 1570 (Part 1) : 1978
8	Cylinder liner	Cast iron	GR AFG 1A IS 2749 :1974
9	Pistons	Cast iron	FG 260 IS 210 : 1978
		Aluminium	Casting Gr 4685 WP IS 617 : 1975

Sl No.	*Component*	*Material*	*Minimum Grade*
10	Cylinder head	Cast iron	FG 260 IS 210 : 1978
		Spheroidal grey iron	SG 600/3 IS 1865 : 1991
		Forged steel	620 IS 1570 (Part 1) : 1978
11	Piston rod	Steel	40 Ni10Cr3Mo6 IS 5517 : 1978
		Stainless steel	15Cr13 IS 1570 : (Part 2/Sec1) : 1979
12	Piston rod nut	Steel	40C8 IS 5517 : 1978
13	Valve seat and valve guards	Stainless steel	Grade 2 IS 3444 : 1987
		Cast iron	FG 260 IS 210 : 1978
14	Valve spring	Stainless spring steel	Grade 2 IS 4454 (Part 4) : 1975
15	Packing cases	Steel	Grade A IS 2062 : 1992, IS 1570 (Part 2/ Sec1) :1979
		Cast iron	FG 260 IS 210 :1978
16	Packing case flange	Cast iron	FG 260 IS 210 :1978
17	Piston ring	Non- metallic	Carbon filled teflon/ Glass filled teflon
		Malleable cast iron	A 4 IS 5791 : 1986
18	Rider ring	Non-metallic	Carbon filled teflon/ Glass filled teflon
		Malleable cast iron	A 4 IS 5791:1986
19	Packing ring	Steel	Grade A IS 2062 : 1992
		Bearing Alloy	10C4 IS 4432 : 1982 BRG Material Grade 84 IS 25 : 1979

5 ENQUIRY AND PROPOSAL

5.1 General

5.1.1 In case of conflict between this standard and enquiry or order, the information included in data sheets/ order shall govern.

5.1.2 Approval of documents (drawings) does not constitute permission to deviate from order requirements. Any deviations from requirements shall be specifically agreed upon between the purchaser and the supplier.

5.2 Enquiry

The purchaser shall complete data sheets 1 to 35 (*see* Annex B) to the extent possible and specify all process requirements, any known abnormal conditions. The purchaser shall clearly indicate the deviations acceptable from this standard at the time of enquiry.

5.3 Proposal

5.3.1 The supplier shall include the data required in data sheets in his proposal, completed as applicable and as directed by the purchaser.

5.3.2 Unless otherwise specified in the enquiry, the supplier shall quote for instruments/accessories/auxiliaries as recommended for duty applications based on manufacturers experience. The supplier shall clearly list/specify the above items offered for fulfilling the process requirements. However, the scope of supply shall be as agreed between the supplier and the purchaser.

5.3.3 The supplier shall list out the deviations from this standard, if requested by the purchaser, for his guidance.

5.4 Erection and Commissioning

The conditions for erection and commissioning of machine shall be as agreed upon between the supplier and the purchaser.

5.5 Guarantee

5.5.1 *Performance Guarantees*

5.5.1.1 Unless specific deviations are recorded by the supplier in the proposal, following guarantees shall be considered:

a) Rated capacity of the compressor shall be plus 5 percent unless purchaser specifies the less negative tolerance. In such cases the plus tolerance shall be 5 percent.

b) The specific power consumption shall be maximum plus 4 percent than the guaranteed figure mentioned in the proposal.

5.5.2 *Performance Acceptance Test*

Performance test (that is, capacity, power consumption, etc) shall be carried out when they have been specified by the purchaser. The purchaser and the supplier shall jointly determine the nature of the required performance tests and the performance test procedures shall be as specified in IS 5456 : 1985.

5.5.3 *Workmanship Guarantee*

5.5.3.1 All the equipments, components, spare parts shall be guaranteed by the supplier against defects which despite proper use appear therein and arise from improper materials, faulty workmanship.

5.5.3.2 The supplier shall pass on to the purchaser, the guarantee of equipments/parts procured from sub-vendors.

5.5.3.3 All the equipments, components and spare parts other than the bought out items shall be guaranteed by the supplier against the manufacturing defects which arising from defective and improper materials, poor or faulty workmanship. This guarantee shall be applicable for a period of 12 months from the date of supply or 2 000 working hours from the date of installation of the compressors whichever is earlier. However, this guarantee is not applicable to the spare parts having short self life. If any defects or malperformance is established during the guarantee period, the supplier shall make all necessary or desirable alterations, repair and replacements free of charge.

5.6 Order

5.6.1 The purchaser shall specify categorically the agreed deviations/exceptions to this standard in the purchase order.

5.6.2 The purchaser shall specify the following in the purchase order:

a) Site area classification and temperature groups.

b) The choice of actuating signal from upstream or downstream pressure for capacity control, depending upon the suitablity of the process.

c) In case of condensible gas, specific gravity of liquid condensate and the rate of liquid carry over from upstream side of compressor.

d) The chemical properties of the gas including the process parameters at which the gas start decomposing or start liquifying, etc.

6 COMPRESSOR

6.1 General Compressor

Primemover and auxiliary equipment shall be selected for continuous duty at the specified operating conditions. While selecting, care shall be taken so that maintenance shall be carried out easily.

6.2 Allowable Speeds

6.2.1 The crankshaft speed and mean piston speed shall be selected by the supplier so that satisfactory operation is obtained under the required service conditions over a suitable period according to the state of the art. The supplier shall state the mean piston speed in the data sheet.

6.2.2 The supplier shall specify the maximum and minimum crankshaft speeds in the operating instructions.

6.2.3 Limiting values of crankshaft speeds and mean piston speeds depend not only on the compressor design but also on the compressor duty, that is, type of gas, lubrication, pressure, etc.

6.2.4 The purchaser shall only give maximum allowable values in the enquiry and order specifications if special experience indicates that this is necessary.

6.2.5 If purchaser wants to restrict piston speeds for his application, he shall specify clearly in the data sheets.

6.3 Maximum Allowable Working Temperature

6.3.1 Under all specified operating conditions, the maximum expected discharge temperatures shall be selected so as to ensure reliable operation. Detailed specifications of the maximum allowable working temperatures cannot be given here, as the limit values depend on type of gas, lubricant and compressor design.

6.3.2 The supplier shall notify the regulations valid in the user's country. Temperature limits due to process requirements or based on experience shall also be specified by the purchaser.

6.4 Piston Rod Load

Actual piston rod load calculated on the basis of the relief valve set pressure for each stage and the normal suction pressure for each stage considering part load, if applicable, shall not exceed the allowable rod load.

6.4.1 For all specified operating load steps, the horizontal components of combined rod loading shall fully reverse between cross head pin and bushing during any complete turn of the crankshaft. As a general guide, the duration of this reversal shall not be less than 15 degree (0.26 radian) of crank angle and the magnitude of the peak combined reversal load shall be at least 3 percent of the actual combined load in opposite direction. (In most cases, this reversal is required to maintain proper lubrication between cross head pin and bushing).

6.4.2 The piston rod should be induction hardened having the hardness of minimum RC 50 for carbon steel material and minimum RC 40 for stainless steel material, for the packing ring with metallic backup rings, if the duty conditions call for the same.

6.4.3 The maximum allowable piston rod run out shall not exceed 75 micron , if measured during hot condition in the horizontal plane.

6.5 Torsional Vibrations and Shaft Irregularity

6.5.1 For direct coupled drive/geared drive (including V-belt drive), the supplier shall be responsible to carry out torsional vibration analysis after the receipt of order and ensure that the system is free from dangerous torsional vibration within the operating range.

6.5.1.1 Torsional natural frequencies of the driver compressor system (including coupling and any gear unit) shall be avoided within 10 percent of any operating shaft speed and within 5 percent of any other multiple of the operating shaft speed in the rotating system up to and including the tenth multiple. For motor driven compressors this shall be separated from the first and second multiple of the electrical power frequency by the same range.

6.5.2 In case, the primemover is not the scope of supplier, the purchaser shall provide the details to the supplier to carry out analysis. Any changes required to carry out in the system to make system operable, the purchaser shall bear the cost of such modifications.

6.5.3 In case of variable drive, the supplier shall clearly indicate the speed limits.

7 Shaft Speed Irregularity

The shaft speed irregularity shall not exceed the values mentioned in Table 1 at full load operation. When resilient couplings are used their influence shall also be considered.

Table 1 Shaft Speed Irregularity

(*Clause* 7)

Shaft Input Power (kW)	0-50	51-100	101-200	Above 200
Belt drive	1/50	1/60	1/70	1/80
Direct driven by electirc motor	1/60	1/70	1/80	1/100
Gear Box	1/100	1/100	1/100	1/100

8 FOUNDATION

The supplier shall provide the necessary design data such as static load, coordinate of centre of gravity of the compressor and the primemover, unbalanced forces and moments (dynamic load) and the foundation layout drawing to enable the purchaser to carry out the foundation design and construction.

9 DESIGN REQUIREMENTS OF COMPRESSOR

9.1 Bearing

Normally, journal type bearings shall be used. However, taper roller type, antifriction bearing shall be acceptable as main bearing in the compressor with nominal frame ratings of 150 kW or less. Cylindrical roller or ball type antifriction bearings shall not be used. The crankshaft bearing system design shall be suitable for operation with any axial forces which may occur under the operating conditions, for example, motor thrust.

9.2 Crankshaft/Connecting Rod

Crankshaft and connecting rod shall be made of ductile material, such as, forged steel. This also includes suitable grade of spheroidal graphite cast iron. The crankshaft and connecting rod shall be subjectod to non-destructive testing for cranks and defects.

9.2.1 The crank case shall be sufficiently rigid to withstand all operating conditions at full or part load. This shall be totally enclosed with a breather arrangement.

In special cases where purchaser requires, crank case explosive relief device shall be provided.

9.3 Distance Pieces

Distance pieces, may be the integral part of the crosshead guide or may be separate parts fitted to the crosshead guide, shall be provided.

9.3.1 The purchaser shall specify which of the following distance pieces are required:

Type 1 — Short distance piece with oil wiper packing, but without oil slinger. The length of the distance piece shall be enough for removal of cylinder packing. (*see* Fig.1) . This type of distance piece shall be selected for lubricated compressor handling non-toxic and non-hazardous gas which do not contaminate with frame lubricating oil.

Type 2 — Long single compartment distance piece with oil wiper packing as well as oil slinger. The length of the distance pieces shall be adequate so that portion of the piston rod entering the cylinder packing shall not enter the oil wiper packing (*see* Fig. 2). This type of distance piece shall be selected for non-lubricating compressors handling, non-toxic, non-corrosive and non-hazardous gases. If specified by the purchaser, this type of distance piece may also be used by lubricated compressors.

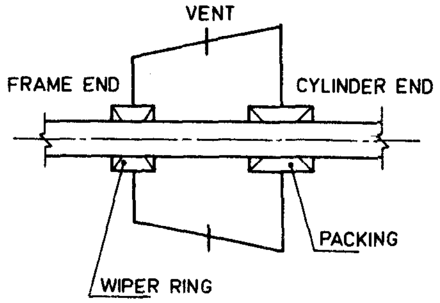

FIG. 1 SINGLE COMPARTMENT — TYPE 1

Type 2A— For compressors handling non-corrosive and non-toxic gases, Type 2 distance piece with additional pressure packing towards crank case may be used. This distance piece compartment may be provided with purging, if required.

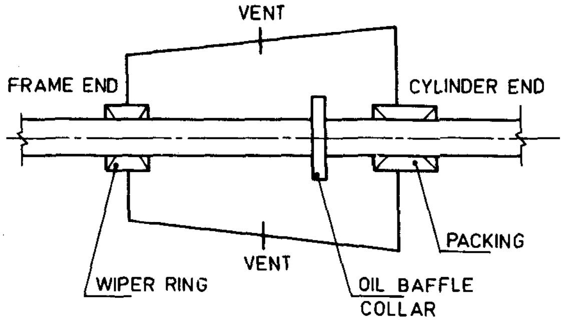

FIG. 2 EXTRA LONG SINGLE COMPARTMENT — TYPE 2

Type 3 — Two compartment gas-tight distance piece (CTDP) having gas- tight packing case at frame end of each distance piece and oil wiper packing at the frame end of frame side distance piece –(Inboard distance piece) (*see* Fig. 3). This type of distance piece shall be selected for lubricated compressor handling toxic and hazardous gas which do not contaminate with frame lubricating oil. This distance pieces compartment may be provided with purging.

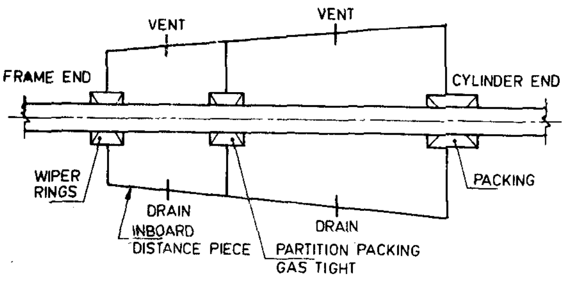

FIG. 3 DOUBLE COMPARTMENT — TYPE 3

Type 4 — Two compartment gas-tight distance piece having oil slinger in frame side distance piece (inboard distance piece); otherwise similar to Type 3. The length of frame side distance piece (Inboard distance piece) shall be adequate so that portion of the piston rod entering the gas-tight packing case shall not enter the oil wiper packing. (*see* Fig. 4). This type of distance piece is to be selected for non-lubricated compressors handling toxic and hazardous gas. These distance piece compartments may be provided with purging, if required.

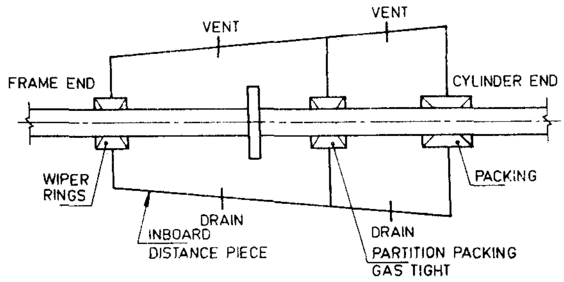

FIG. 4 DOUBLE COMPARTMENT — TYPE 4

Type 5 — Two long compartments distance piece design to contain flammable, hazardous or toxic gases. No part of the piston rod shall alternatively enter wiper packing, intermediate seal packing and gas cylinder pressure packing. Segmented packing shall be provided between two compartments. Provision of lubrication of this segmental packing, if necessary, shall be furnished by the purchaser (*see* Fig. 5). This arrangement would prevent excessive leakage due to differential wear of piston rods. These distance piece compartments may be prioivided with purging, if required.

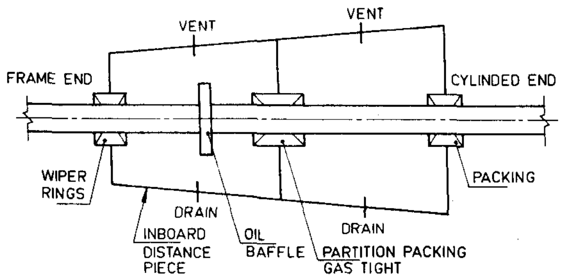

FIG. 5 TWO LONG COMPARTMENT DISTANCE PIECE — TYPE 5

9.3.2 This distance piece shall have cover with gasket joint. The distance piece shall withstand minimum pressure of 0.1 MPa.

9.3.3 Each distance piece shall have drain and vent connections. Each distance piece shall have adequately sized covers for easily accessibility and maintenance of packings.

9.4 Cylinder

The maximum allowable working pressure shall exceed the rated discharge pressure by at least 10 percent or one bar whichever is higher. In any case, it shall not be less than relief valve set pressure.

9.4.1 Horizontal cylinders are required for handling saturated gases. All horizontal cylinders shall have bottom discharge connections.

9.4.2 The discharge connections of all cylinders shall be provided at the bottom when the condensation is likely to take place during compression of gas. The cylinders shall be so arranged that the valve covers, valves, pressure packings, etc, shall be attended without major parts removal.

9.4.3 Supplier shall provide cold cylinder support, if required.

9.4.4 Cylinder heads, cylinder packing, valve covers and clearance pockets shall be mounted on the studs.

9.5 Cylinder Liners

At purchaser's request or if severe wear is to be expected because of the operating conditions, for example, in the compression of dirty, corrosive or condensing gases or with discharge pressure exceeding about 5.0 MPa and for cylinders of cast steel replaceable liners are recommended. Cylinders without liners shall have walls of sufficient thickness to allow reboring of at least 3 mm in the diameter without encroaching upon either the maximum allowable working pressure or maximum allowable rod load. Wet cylinder liners shall not be permitted in case of corrosive gases.

9.5.1 The running bores shall be finished to manufacturer's requirements, but shall not exceed the following root mean square (RMS) values :

a) In lubricated cylinder for piston with metallic rings or wear bends.

Cylinder Bore (mm)	*Finish* (μm)
Less than 508	0.8
More than 508	1.6

b) In non-lubricated cylinder and in lubricated cylinder for piston with non-metallic rings or wear bends:

Cylinder Bore (mm)	*Finish* (μm)
Less than 254	0.2
254 to 508	0.4
More than 508	0.8

When specified by the purchaser, cylinder bores shall be flourocarbon aerosol sprayed.

9.6 Cooling Systems

Separate Non-interconnected Jacket

When there are chances of cooling water mixing with gas and forming corrosive liquid, poisonous liquid potential explosive substance, non-interconnected jackets shall be required for cylinder body and cylinder head.

The cooling system cylinders shall be fitted with vent at the top to take out the air trapped in the system. The drain point at the lowest portion of the system shall also be provided.

9.6.1 The cooling water system shall be forced type, designed for 0.5 MPa working pressure and 0.2 MPa maximum pressure drop. The recommended flow rates shall be based on 10°C temperature rise.

9.6.2 To avoid gas condensation in cylinder, handling saturated gases, the purchaser is cautioned regarding the following:

a) The cooling water inlet temperature to cylinder jackets shall be minimum 5°C higher than the suction temperature, otherwise gas gas condensation may take place.

b) Cooling water outlet temperature exceeds more than 17°C above the gas inlet temperature results in capacity reduction. The purchaser shall make provision for the supply of cooling water at suitable temperature depending upon gas inlet temperature.

9.6.3 For gas inlet temperature below 0°C, special consideration shall be required to avoid freezing of cooling water inside the jacket of cylinder/heads.

9.6.4 Static filled or thermo-syphon cooling water system shall be supplied when expected maximum gas discharge temperature is less than 95°C and when ambient temperature is less than 45° C.

9.6.5 The main inlet and outlet gas connection shall be either flanged or flat faced bosses to match with the counter flanges suitable for the maximum working pressure of the cylinder.

9.6.6 Packing case flange shall be bolted to the cylinder head with not less than 4 bolts f foras gas discharge pressure above 1.2 MPa.

9.6.7 Cylinder packing case shall be water cooled type only, if required. Oil cooling is not recommended.

9.6.8 The purchaser shall make arrangement for clean and treated cooling water at a supply pressure not less than 0.2 MPa and the outlet of this cooling water from the packing case to be left to open funnel. The manufacturer shall specify the required cooling water flow in their manual.

9.6.9 The material of construction of cylinder and head shall be mutually agreed between the manufacturer and the purchaser to suit the service conditions. The manufacturer shall specify the grade of the material but shall not be less than FG 260 of IS 210 : 1978. The cylinder shall have a reboring allowance of 3 mm.

9.7 Compressor Valve

The valve and port design shall be such that no inlet valve shall be fitted instead of a discharge valve in a wrong way.

9.7.1 Valve seat and valve gaskets shall be either of solid metal or metal jacketed.

9.7.2 Valve hold-downs shall be at least at three points to ensure reliable holding. Valve hold-downs using crab-type loading shall be acceptable.

9.7.3 The purchaser shall specify in the data sheet any specific design of unloaders. In case no specific mention has been made, the supplier shall offer unloading arrangement of his choice, and shall mention in the offer.

9.7.4 For outside operated pneumatic unloaders, the purchaser shall make an arrangement for instruments air at pressure between 5 to 7 bars at atmospheric dew point of – 40°C

9.8 Piston, Piston /Rider Rings and Packings

The purchaser shall specify any specific material for the piston, based on the duty and application. The removable piston shall be positively locked in place with the rod.

9.8.1 Piston. rings and rider rings (if required) shall be of single piece construction. Rider rings shall be designed to prevent underside pressurization. Piston/rider rings when provided shall not over run valve port of cylinder/liner counterbore by more than 1/3 and half of the ring's width, respectively. For non-metallic rider rings, the bearing pressure shall not exceed 34.3 kPa and 68.6 kPa for non-lubricated and lubricated construction respectively. For calculating rider rings bearing pressure, weight of entire piston assembly plus half of piston rod and projected area of 120° of rider ring shall be considered.

9.8.2 Hollow pistons shall be self venting type.

9.8.3 The packings shall be of self adjusting type to increase the utilization period without any attention for adjustment and to avoid any gas leakage on account of increased clearances.

9.8.4 The supplier shall include in his offer any special tools which are not available readily in the market and required for compressor maintenance.

9.8.5 The purchaser shall specify in the data sheet whether the installation is indoor, outdoor, with or without roof. The storage period before installation covered or uncovered storage,etc.

9.8.6 The purchaser shall specify in his data sheet, the exact gas analysis, their properties and draw specific attention to the particular gas properties that are important for design and operation of the compressor. These are in addition to corrosiveness, toxicity, danger of explosion, fire, polymerisation, condensation, etc.

9.8.7 The supplier shall take into account carefully the gas properties and arrange materials; design, operating instruments accordingly.

9.9 Driver and Drive Arrangements

The purchaser shall specify in the data sheet the type of drive preferred and if any alternative is acceptable.

9.9.1 *Driver*

The purchaser shall specify the standards, codes, margin over BHP of compressor; classification, etc, in his data sheet applicable for the driver. The purchaser shall also supply the technical data necessary for the driver, for example, electrical supply, steam condition, diesel oil or any other fuel natural gas, etc. Whenever not specified by the purchaser, the supplier shall select the primer to match 110 percent of the maximum power (Input at compressor shaft transmission loss, if any required by compressor.

NOTE— This 10 percent margin covers any tolerances on capacity and specific power. If specified by the purchaser, the driver selection shall be based on the relief valve set pressure.

9.9.2 The supplier shall take into account, while designing, the start up condition, if specified by the purchaser. If no specific mention has been made by the purchaser, the supplier shall specify the start up condition considered for selection of the driver.

9.10 Coupling

The coupling selection shall be based on the maximum torque transmission during operation of compressor. The couplings shall also satisfy any torque fluctuations established by carrying out torsional vibration analysis of shaft system.

9.11 Gear Box

Gear box shall be designed to take into account cyclic torque variations as specified by the supplier. In no case the capability of continuous mean torque transmission be less than twice the power at compressor shaft.

9.11.1 The rotation of direction shall be clearly shown/marked by the arrows on the gear box housings. The metallic non-corrosive arrows shall be preferred.

9.12 Belts

The belts, if used for driving the compressor shall be suitable for the duty and application specified in the data sheet. The purchaser shall specify in the data sheet his choice of belts, that is, flat, V, banded, V belts, etc.

9.13 Guards

Guards shall be included in the scope by the supplier to safeguard operating personnel from moving parts. The purchaser shall specify the type of guard, that is, antistatic, expanded metal, etc, if specifically required and nothing specified, the supplier shall supply his own requirements.

9.14 Barring Device

If the barring device is required the purchaser shall specify in the data sheet.

9.15 Lubrication

9.15.1 *General*

The supplier shall specify full particulars about the type of oil and its equivalent to be used for frame and cylinder block (if lubricated).

9.15.1.1 The frame lubrication system shall be pressurised systems. Splash system is not recommended. Crank case oil temperature shall not exceed 70°C for ambient temperature of 40°C. Pressurised lubrication system shall consist of suction strainer and an inbuilt relief valve, oil pump, fuel flow filter and other necessary instruments to be mutually agreed upon. In case of separate oil pump (not shaft driven), an interlock for compressor master to start is to be provided until safe oil pressure is developed.

9.15.1.2 The purchaser shall specify, if any electric motor driven auxiliary oil pump, manually flushing oil pumps, dual oil filter and differential pressure gauge, is required.

9.15.2 Unless otherwise specified by the purchaser, the supplier shall provide adequate lubrication system and safety devices necessary for safe operation. The oil pump may be driven by a separate motor. The purchaser shall specify his choice. This does not restrict supplier the type of drive. The pump may be driven by crankshaft, chain, gear box, however, no V belts are used. The oil pump shall have provision for operation prior to start-up.

9.15.3 If specified by the purchaser, the supplier shall quote a stand-by pump in parallel to the existing, so that the changeover shall be carried out.

9.15.4 Compressors having pressure lubrication, the supplier's standard full flow lubricating oil filter shall be provided. The filtration shall be 25 μm. The supplier shall supply fine filtration, if felt necessary.

9.15.5 Shell and tube type water cooled oil cooler shall be provided to maintain lubrication supply of oil temperature below 45° C for frame rating of more than 200 kW. The purchaser shall specify, if an oil cooler is required for frame having rating less than 200 kW.

9.15.6 Low oil pressure gauge and low oil pressure shut down switch shall be provided.

9.15.7 Frame oil piping shall be of steel with carbon steel fittings down stream of filter. The purchaser shall specify if steel fittings are required. The oil piping shall be designed for minimum 1.0 MPa.

9.15.8 The packings shall have a pressure lubrication to increase the sealing effect, for lubricated compressor. For non-lubricating compressors, the packings shall have self lubrication properties.

9.15.9 In case of lubricated compressors, the cylinders shall be lubricated with force feed pump (normally known as lubricator). The lubricator shall have the provision for operation prior to start-up.

9.16 Control and Instrumentation

The purchaser shall clearly indicate in the data sheet points where temperatures and pressures are required to be measured. The supplier shall submit with offer the PI diagram indicating the instrumentation included. This PI diagram shall be considered as a reference and final PI diagram shall be submitted by the supplier for the approval of the purchaser.

9.16.1 The purchaser shall specify the type of control, that is, pneumatic, electro pneumatic, dual, etc, in the data sheet.

9.16.2 The purchaser shall also specify the required capacity control and the cycle of operation expected.

9.17 Gauges

The pressure gauges offered shall be suitable for the gas, the compressor is handling and shall be provided with dampening arrangement.

9.17.1 The dial sizes selected shall be minimum 100 mm, unless otherwise agreed by the purchaser.

9.17.2 The panel on which these gauges are mounted shall be located at a place which shall not hinder in operator's work and the operator shall easily note the reading.

9.17.3 Any electrical component, equipment, like solonoid valve; pressure switch, etc (except the temperature gauge with tripping switch) shall be mounted on a separate panel.

9.17.4 The purchaser shall state in his enquiry, the scope of wiring, instrumentation cables, power cables, etc, as well as the requirements of flameproof electricals.

9.18 Accessories

All the pressure vessels and Coolers being offered shall conform to IS 2825 : 1969 and IS 4503 : 1967 respectively. If any special treatment/coating is required, the purchaser shall state the same in his enquiry. The purchaser shall also specify the relevant Indian Standards for other accessories in the enquiry/tender. The manufacturer may also quote the accessories to be required as per Indian Standards in the enquiry/tender. This shall be mutually agreed upon and shall be mentioned categorically in the purchaser order.

9.18.1 The purchaser shall specify any limitation on the water temperature rise in the cooler, however, the outlet water temperature from the cooler shall not exceed 45°C. If no specific mention about the temperature rise of water has been made by the purchaser in his enquiry, the supplier shall limit the temperature rise to 12°C maximum, while the maximum outlet temperature condition as specified above (45°C) remains unchanged. If required, the purchaser shall make arrangement for the cooling water supply and return at higher temperature to avoid condensation of gas in the cylinder.

9.18.2 The purchaser shall state in his enquiry, the corrosion allowance on the calculated wall thickness. Unless otherwise specified, the corrosion allowance shall be 1.5 mm minimum for carbon steel material.

9.18.3 Whenever automatic draining arrangement has been selected, manually operated by pass arrangement shall also be provided by the supplier.

9.18.4 The purchaser shall state in the enquiry, the percentage pulsation dampening required at suction and delivery battery limits. Unless, otherwise specified, the dampening at the suction and delivery battery limits shall be maximum 12 percent.

10 INSPECTION AND TESTS

10.1 The supplier and the purchaser shall agree for the type of inspection of components, sub-assembly, boughtout components, etc.

10.2 The compressor shall be tested for its capacity, specific power, etc, at the supplier's works with air as working media, if mutually agreed upon.

10.2.1 However, number of hours running, strip down test, string test,etc,shall be as per the agreement between the supplier and the purchaser.

10.3 The supplier shall provide test certificates as demanded by the purchaser for the major components, parts, etc.

10.4 The inspection procedure for the pressure vessels, heat exchangers, moisture separaters, etc, shall be as agreed between the supplier and the purchaser.

10.5 The purchaser shall specify the sealing test specifically, where the gases are toxic, corrosive and hazards. The method of test shall be as agreed to between the supplier and the purchaser.

10.6 If no specific mention has been made in the data sheet, the supplier shall carry out leakage test as per his own requirements and provide a certificate at which the test has been carried out.

11 RUNNING TEST

11.1 The purchaser shall indicate clearly the details of running test at the time of enquiry.

11.2 If the site performance test on gas stream has been agreed to between the supplier and the purchaser, the purchaser shall provide all the facilities including instrumentation use with the gas other than provided on the compressor. The purchaser shall be responsible to maintain the working condition of upstream of compressor to the requirements mentioned in data sheets.

11.2.1 If the purchaser desires any testing equipment to be manufactured by the supplier, the supplier shall do so, however, the charges shall be borne by the purchaser.

11.3 If the testing is carried out at the supplier/manufacturer's works, the supplier shall provide all the facilities to the purchaser or his authorised representative. The charges, if any, shall be as agreed between the supplier and the purchaser.

11.4 The charges for any deviations recorded during testing than the contractual values shall be as agreed upon between the purchaser and the supplier.

12 MARKING

Name plate and rotation arrows shall be fixed at appropriate place.

12.1 The name plate shall give the following details:

a) Indication of the source of manufacture;

b) Serial number;

c) Design code;

d) Speed of compressor;

e) Working pressure/temperature of gas;

f) Hydrostatic test pressure of cylinder;

g) Bore size and stroke of each cylinder; and

h) Piston displacement of each cylinder.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
25 : 1979	Antifriction bearing alloys (*third revision*)
210 : 1978	Grey iron castings (*third revision*)
617 : 1975	Aluminium and aluminium alloy ingots and castings for general engineering purposes (*second revision*)
1570 (Part 1) : 1978	Schedules for wrought steels : Part 1 Steels specified by tensile and/or yield properties (*first revision*)
1570 (Part 2/Sec1) : 1979	Schedules for wrought steels : Part 2 Carbon steels (Unalloyed steels), Section 1 Wrought products (Other than wire)with specified chemical composition and related properties (*first revision*)
1865 : 1991	Iron castings with spheroidal or nodular graphite (*third revision*)
1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings (*fifth revision*)
2062 : 1992	Steel for general structural purposes (*fourth revision*)
2749 : 1974	Austenitic iron castings (*first revision*)
2825 : 1969	Code for unfired pressure vessels
3444 : 1987	Corrosion resistant alloy steel and nickel castings for general applications (*second revision*)
4431 : 1978	Carbon and carbon manganese free-cutting steels (*first revision*)
4432 :1988	Case hardening steels (*first revision*)
4454 (Part 4) : 1975	Steel wires for cold formed springs : Part 4 Stainless spring steel tempered steel wire for normal corrosion resistance (*first revision*)
4503 :1967	Shell and tube type heat exchangers
5456 : 1985	Code of practice for testing of positive displacement type air compressors and exhuasters (*first revision*)
5517 :1978	Steels for hardening and tempering (*first revision*)
5727 :1981	Glossary of terms relating to compressors and exhausters (*first revision*)
5791:1986	Technical supply conditions for piston rings for internal combustion engines (*second revision*)
6754 : 1972	Aluminium alloy ingots for bearings

ANNEX B

(Clause 5.2.)

1	Re-vision	Info.	**COMPRESSOR DATA SHEET No. 1**				
2			CONDITIONS OF SERVICE				Page of
3			**USER :**	**PROJECT :**		**SUPPLIER :**	
4							
5							
6			Ref. No.	Ref. No.		Ref. No.	
7							
8			Operating point ☒ = normal operating point	☐	☐	☐	☐
9			Process stage				
10			Model designation				
11			Gas designation (see data sheet 2)				
12			Designation of operating point				
13			Rating point	☐	☐	☐	☐
14			**No. of units for service**				
15			**No. of standby units**				
16			Inlet mass rate of flow ☐ kg/s ☐ kg/h ☐ wet ☐ dry				
17			**Discharge mass rate of flow**				
18			☐ kg/s ☐ kg/h				
19			Mass rate of flow tolerance (%)				
20			Inlet volume rate of flow ☐ m^3/s ☐ m^3/h ☐ wet ☐ dry				
21			Inlet volume rate of flow tolerance (%)				
22							
23			**Inlet absolute pressure** (MPa)				
24			**Inlet temperature** (°C)				
25			γ (= $\varkappa$ = c_p/c_V for ideal gases only)[1]				
26			Compressibility factor Z (= pV/RT)				
27			**Discharge absolute pressure** (MPa)				
28			Discharge temperature (°C)				
29			γ (= $\varkappa$ = c_p/c_V for ideal gases only)[1]				
30			Compressibility factor Z (= pV/RT)				
31			Absolute backpressure on relief valve (bar)				
32			Compressor required power (kW)				
33			Specific energy requirement (actual) (kJ/m^3)				
34			Specific energy tolerance (%)				
35			Compressor speed (r/min)				
36			Driver coupling power (kW)				
37			Combined driver coupling power (kW)				
38			Recommended driver power (kW)				
39			Driver shaft speed (r/min)				
40			**Type of driver**	☐ electric motor	☐ steam turbine	☐ combustion engine or gas turbine	
41				☐ diesel engine	☐ gas engine	☐ expander	
42				☐ other :			
43			Manufacturer of driver :				**Furnisher :** ○ U ○ S
44			Inlet point	☐ standard			
45				☐ other :			
46			Discharge point	☐ standard			
47				☐ other :			
48			Attendance interval	☐ 1 h	☐ 4 h	☐ 8 h	☐ 24 h
49				☐ no routine attendance			
50			Service	☐ 3 shifts	☐ 1 shift	☐ intermittent	☐ other :
51							
52			1) $pV^\varkappa$ = constant for isentropic change of state.				
53							
54			USER to mark X in Info. column where data required in SUPPLIER's proposal				

55			Revision No.	Original	1	2	3	4	5	6	7	8	9	55
56			Name											56
57			Date											57

	Re-vision	Info.				
1			**COMPRESSOR DATA SHEET No. 2**			1
2			GAS COMPOSITION		**Page of**	2
3			**USER:**	**PROJECT:**	**SUPPLIER:**	3
4						4
5						5
6			Ref. No.	Ref. No.	Ref. No.	6
7						7

8			Operating point							8
9			**Gas designation**							9
10			Process stage							10
11			**Relative water vapour pressure**							11
12										12
13			Solid impurities (see constituents)			☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	13
14			Toxic (see constituents)			☐	☐	☐	☐	14
15			Flammable (see constituents)			☐	☐	☐	☐	15
16			Corrosive (see constituents)			☐	☐	☐	☐	16
17										17
18			**Constituents**	Symbol	Molar mass	mol. %	mol. %	mol. %	mol. %	18
19			Water	H_2O	18,02					19
20			Hydrogen sulfide	H_2S	34,08					20
21										21
22										22
23										23
24										24
25										25
26										26
27										27
28										28
29										29
30			Molar mass M		(kg/kmol)					30
31			Gas constant R		(kJ/kg·K)					31
32			Specific heat capacity c_p		(kJ/kg·K)					32
33			Reference temperature for c_p		(°C)					33
34										34
35										35
36			Gas fouling factor for heat exchanger		(m^2·K/W)					36
37			Temperature limits due to process requirements:							37
38			maximum		(°C)					38
39			minimum		(°C)					39
40										40
41			Material limitations:							41
42										42
43										43
44			Leakage limits:							44
45										45
46										46
47			Reference for thermodynamic properties:							47
48										48
49										49
50										50
51										51
52										52
53										53
54			USER to mark X in Info. column where data required in SUPPLIER's proposal							54

55			Revision No.	Original	1	2	3	4	5	6	7	8	9	55
56			Name											56
57			Date											57

Re-vision	Info.	COMPRESSOR DATA SHEET No. 3		
		SITE CONDITIONS, ARRANGEMENT		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

SITE

Name:

Geographic location:

Altitude above sea:

CLIMATICS

☐ inland ☐ close to sea ☐ desert ☐ tropical

☐ very sandy ☐ very dusty ☐ winter-proof protection required

☐ corrosive atmosphere due to: concentration: mg/m³

Rain: mm/h (maximum rainfall to be expected)

Barometer reading: normal = kPa ; min. = kPa; max. = kPa

Relative water vapour pressure: normal = ; min. = ; max. =

Ambient temperature outdoors: normal = °C; min. = °C; max. = °C

Ambient temperature indoors: normal = °C; min. = °C; max. = °C

INSTALLATION	Compressor	Lubrication system	Intercoolers	Aftercoolers	Control	Steam condensing unit
Outdoors without roof	☐	☐	☐	☐	☐	☐
Outdoors with roof	☐	☐	☐	☐	☐	☐
Indoors unheated	☐	☐	☐	☐	☐	☐
Indoors heated	☐	☐	☐	☐	☐	☐
Integral with casing			☐	☐		
At machine floor level		☐	☐	☐	☐	☐
Below machine centre line (m)						
Above machine centre line (m)						
Horizontal distance from compressor (m)						

☐ Overhead tank m above machine centre line

CRANE

Erection crane ☐ installed ☐ mobile Erection opening: m by m

Erection crane lifting capacity: kg

Maintenance crane ☐ installed ☐ mobile

Maintenance crane lifting capacity: kg

Crane hook: m above machine centre line

Machine centre line: m above machine floor level

Machine floor level: m above ground level

Space required below machine centre line: m

SITE TRANSPORTATION ☐ street ☐ rail ☐ waterway ☐ airfield

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.			
		COMPRESSOR DATA SHEET No. 4		
		UTILITIES 1 (electric power, fluids)		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

ELECTRIC POWER

	Direct current		Alternating current, 1 phase				Alternating current, 3 phases			
		V		V	50 Hz	60 Hz		V	50 Hz	60 Hz
Power up to: kW	☐		☐		☐	☐	☐		☐	☐
Power up to: kW	☐		☐		☐	☐	☐		☐	☐
Control instruments	☐		☐		☐	☐	☐		☐	☐
Switches, relay	☐		☐		☐	☐	☐		☐	☐

Total electric power consumption: main driver = kW; auxiliaries = kW

REQUIREMENTS FOR EXPLOSIVE GAS ATMOSPHERE

Applicable standards (see also data sheet 7):

Location	Area classification	Gas composition	Type of protection			
			Explosion-proof enclosure	Increased safety "e"	Pressurizing allowable	Intrinsically safe system
Indoors				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
Outdoors				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
Control room				☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no

FLUIDS

	Medium	Pressure (MPa)			Temperature (°C)			Relative water vapour pressure	Consumption	
		normal	min.	max.	normal	min.	max.		units	max.
Compressed air	air									
Instrument air	air									
Control gas										
Purge gas										
Seal gas										
Live steam	steam									
Exhaust steam	steam									
Heating steam	steam									
Fuel gas	1)									

Fuel oil: density = kg/m³; lower calorific value = kJ/kg

1) See data sheet 2.

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Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.		
		COMPRESSOR DATA SHEET No. 5	
		UTILITIES 2 (cooling water)	Page of

		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Re-vision	Info.	**COOLING WATER**	Units	Design	min.	max.	Design	min.	max.	Design	min.	max.
		Circuit designation										
		Open circuit		☐			☐			☐		
		Closed circuit		☐			☐			☐		
		Recirculation system		☐			☐			☐		
		Inlet effective pressure	MPa									
		Allowable pressure drop	MPa									
		Inlet temperature	°C									
		Allowable temperature rise	K									
		Water consumption:										
		intercooler plus aftercooler	litre/s									
		oil cooler	litre/s									
		auxiliary equipment	litre/s									
		WATER QUALITY										
		Town water		☐			☐			☐		
		River water		☐			☐			☐		
		Cooling tower		☐			☐			☐		
		Sea water		☐			☐			☐		
		Brackish water		☐			☐			☐		
		Other										
		Solid impurities		☐			☐			☐		
		(see analysis)										
		Corrosive water		☐			☐			☐		
		(see analysis)										
		pH										
		Fouling factor water-side	$m^2 \cdot K/W$									
		WATER ANALYSIS										
		Constituents										
		Ammonia	g/m^3									
		Chlorides	g/m^3									
		ANTIFREEZE										
		Type										
		Concentration	%									

USER to mark X in Info. column where data required in SUPPLIER's proposal

		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.			
		COMPRESSOR DATA SHEET No. 6		
		MACHINE MOUNTING		Page of
		USER :	**PROJECT :**	**SUPPLIER :**
		Ref. No.	Ref. No.	Ref. No.

FOUNDATION

☐ Block foundation	☐ at ground level	☐ elevated : m above ground level
☐ Elevated foundation	☐ concrete table	☐ concrete supports
	☐ skid mounted	☐ other
Compressor mounting	☐ rigid	☐ resilient
Furnisher of resilient elements	○ USER	○ SUPPLIER
Subsoil condition	☐ piled	water table : m below ground level
	☐ rocky	

Earthquake susceptibility factor (give applicable standards in data sheet 7) :

BASEPLATES, SOLEPLATES

	Baseplates separate	Baseplates common	Soleplates	Rails
Driver	☐	☐	☐	☐
Gearboxes	☐		☐	
Compressors	☐		☐	
Coolers	☐		☐	
Oil systems	☐		☐	
Steam condensing unit	☐		☐	

FIXING

	Foundation bolts	Furnisher	
		U	S
Compressor	☐	○	○
Gearboxes	☐	○	○
Drivers	☐	○	○
Coolers	☐	○	○
Oil system	☐	○	○

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No.7	
		MISCELLANEOUS	Page of

USER:	PROJECT:	SUPPLIER:
Ref. No.	Ref. No.	Ref. No.

This data sheet may be used to indicate:

Applicable standards (vibration and noise limitations, see data sheet 8)

Mandatory sub-suppliers

Prohibited sizes, ratings or materials

Exceptions

Special cleaning requirements

Major spare parts to be included in proposal

etc.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 8	
		VIBRATION AND NOISE LIMITATIONS	Page of

USER :	**PROJECT :**	**SUPPLIER :**
Ref. No.	Ref. No.	Ref. No.

SOUND POWER LEVEL

Item	Maximum permissible	Expected
	dB(A) re 10^{-12} W	dB(A) re 10^{-12} W

NOISE OUTPUT Octave bands Applicable standards		

R.m.s. VIBRATION [1]

Item	Maximum permissible	Expected
	mm/s^2	mm/s^2

---

[1] R.m.s. = root mean square.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 9		
		RATINGS		Page of
		USER :	PROJECT :	SUPPLIER :
		Ref. No.	Ref. No.	Ref. No.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
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Re-vision	Info.	**COMPRESSOR DATA SHEET No. 10**		
		ARRANGEMENT SKETCH		Page of
		USER :	**PROJECT :**	**SUPPLIER :**
		Ref. No.	Ref. No.	Ref. No.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.

RECIPROCATING COMPRESSOR DATA SHEET No. 11

COMPRESSOR DESIGN 1 (general)

Page of

USER:	**PROJECT:**	**SUPPLIER:**
Ref. No.	Ref. No.	Ref. No.

Compressor model designation:

Number of stages = ; Number of crankthrows =

Machine type ☐ vertical ☐ V-type ☐ W-type ☐ L-type

☐ horizontal opposed ☐ horizontal

Rated compressor speed = r/min or speed range = to r/min

Direction of rotation (when looking onto the compressor driven shaft end):

☐ clockwise ☐ anticlockwise

Motion work

Bearings:	main	crankpin	crosshead pin	crosshead faces
journal type	☐	☐	☐	
rolling element	☐	☐	☐	
pressure lubrication	☐	☐	☐	☐
splash lubrication	☐	☐	☐	☐

Crankcase ☐ Gas-tight type

Distance pieces: to be given on data sheet 12

See Clause 9.3	Figure
Type 1	1
Type 2	2
Type 3	3
Type 4	4
Type 5	5

Total mass: kg (excluding flywheel, baseplates, gas coolers, gears, drive and:)

Maximum lifting capacity – for erection: kg

– for maintenance: kg

Schematic diagram for motion work and cylinders:

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

1	Re-vision	Info.	**RECIPROCATING COMPRESSOR DATA SHEET No. 12**			1
2			COMPRESSOR DESIGN 2 (cylinders)		Page of	2
3			**USER:**	**PROJECT:**	**SUPPLIER:**	3
4						4
5						5
6			Ref. No.	Ref. No.	Ref. No.	6
7						7

8			CYLINDERS								8
9			Cylinder No. (cf. schematic diagram on data sheet 11)		1	2	3	4	5	6	9
10											10
11			Compressor stage								11
12			Cylinder diameter	(mm)							12
13			Piston stroke	(mm)							13
14			Piston rod diameter	(mm)							14
15			Relative clearance volume	(%)							15
16			Single acting		☐	☐	☐	☐	☐	☐	16
17			Double acting		☐	☐	☐	☐	☐	☐	17
18			Suction pressure (absolute)	(MPa)							18
19			Discharge pressure (absolute)	(MPa)							19
20			Relief valve set pressure (absolute)	(MPa)							20
21			Suction temperature	(°C)							21
22			Discharge temperature	(°C)							22
23			Allowable rod load	(kN)							23
24			Actual rod load	(kN)							24
25			Rated mean piston speed	(m/s)							25
26			Cylinder liner fitted		☐	☐	☐	☐	☐	☐	26
27			**Cylinder** — lubricated		☐	☐	☐	☐	☐	☐	27
28			— minimum lubricated		☐	☐	☐	☐	☐	☐	28
29			— non-lubricated		☐	☐	☐	☐	☐	☐	29
30			**Packing** — lubricated		☐	☐	☐	☐	☐	☐	30
31			— minimum lubricated		☐	☐	☐	☐	☐	☐	31
32			— non-lubricated		☐	☐	☐	☐	☐	☐	32
33			Packing cooled by liquid circulation		☐	☐	☐	☐	☐	☐	33
34			Valves — type								34
35			— number per cylinder end	suction/discharge	/	/	/	/	/	/	35
36			— velocity	(m/s)							36
37											37
38											38
39											39
40			**Distance piece**: Figure (cf. data sheet 11)								40
41											41
42			Cylinder cooling — air cooled		☐	☐	☐	☐	☐	☐	42
43			— liquid filling		☐	☐	☐	☐	☐	☐	43
44			— thermosyphon		☐	☐	☐	☐	☐	☐	44
45			— liquid circulation		☐	☐	☐	☐	☐	☐	45
46			Coolant — fluid								46
47			— flow rate (normal)	(kg/s)							47
48			— inlet temperature normal	(°C)							48
49			max.	(°C)							49
50			min.	(°C)							50
51			— temperature rise (normal)	(K)							51
52											52
53											53

54			USER to mark X in Info. column where data required in SUPPLIER's proposal											54
55			Revision No.	Original	1	2	3	4	5	6	7	8	9	55
56			Name											56
57			Date											57

Re-vision	Info.	RECIPROCATING COMPRESSOR DATA SHEET No. 13	
		COMPRESSOR DESIGN 3 (materials)	Page of

USER:	**PROJECT:**	**SUPPLIER:**
Ref. No.	Ref. No.	Ref. No.

MOTION WORK MATERIALS

Crankcase:

Distance pieces:

Crankshaft:

Connecting rods:

Crossheads:

Crosshead guides:

Bearings — main:

— crank pin:

— crosshead:

Crosshead faces:

CYLINDER MATERIALS

Cylinder No. (cf. schematic diagram on data sheet 11)	1	2	3	4	5	6
Compressor stage						
Cylinder						
Cylinder head						
Liner						
Liner surfacing						
Piston						
Piston rings						
Piston rider rings						
Piston rod						
Piston rod surfacing						
Packing rings						
Packing cups						
Valve body						
Valve plates						
Valve springs						

User to mark X in Info. column where data required in supplier's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.			
		COMPRESSOR DATA SHEET No. 14		
		COUPLINGS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Re-vision	Info.						
		LOCATION (reference letter of data sheet 10)					
		Location					
		Furnisher		○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer					
		Manufacturer's model designation					
		Manufacturer's coupling torque capability 1)	(Nm)				
		Application factor 8)					
		Rated coupling torque 2)	(Nm)				
		Starting torque ratio 3)					
		Maximum continuous speed	(r/min)				
		Inertia 4)	(kg·m^2)				
		Type of design					
		Spacer/length of spacer coupling		/	/	/	/
		Idling adaptor					
		Limited end float	(mm)				
		Guard furnisher		○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Coupling mass	(kg)				
		Coupling driving end mounted by					
		Coupling driven end mounted by					

1) Torque indicated by manufacturer as design value in his documentation.

2) Highest torque required at any specified operating point of compressor

3) Ratio of starting torque to rated coupling torque.

4) Approximate figure for electric drive only, inertia defined as the mass times the radius of gyration squared.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 15		
		TRANSMISSION AND BARRING DEVICE		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

				Furnisher	
		TRANSMISSION			
				U	S
		Flywheel	☐ yes ☐ no		X
			– diameter = mm		
			– width = mm		
			– grooved ☐ yes ☐ no		
			– mass = kg		
			– inertia 1) = $\mathrm{kg \cdot m^2}$		
		Motor pulley	☐ yes ☐ no		X
			– diameter = mm; speed ratio =		
			– width = mm		
			– grooved ☐ yes ☐ no		
			– mass = kg		
			– inertia 1) = $\mathrm{kg \cdot m^2}$		
			– bore ☐ prebored		
			☐ on required tolerance		
			– mounted ☐ in workshop by:		
			☐ on site by:		
		Belt-drive	☐ yes ☐ no		X
			☐ V-belt; type = ; number =		
			☐ flat-belt; width = mm		
			☐ other		
			application factor = ; belt tension = N		
			approximate centre distance for the drive: mm		
		Outboard bearing			
			– for extension shaft of motor ☐ yes ☐ no		X
			– bearing type ☐ journal ☐ rolling elements		
		Guard	☐ yes ☐ no		X
			– non-sparking design ☐ yes ☐ no		
		Barring device	☐ yes ☐ no		X
			– location (reference letter of data sheet 10):		
			– type of design (manual, electric etc.):		
			– electric motor: type =		X
			data: power = kW; V		

		1) Approximate figure for electric drive only, inertia defined as the mass times the radius of gyration squared.
		USER to mark X in Info. column where data required in SUPPLIER's proposal

		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.					
		COMPRESSOR DATA SHEET No. 16				
		GEARS			Page	of
		USER:		**PROJECT:**		**SUPPLIER:**
		Ref. No.		Ref. No.		Ref. No.
		Location (reference letter of data sheet 10)				
		Location				
		Furnisher		○ u ○ s	○ u ○ s	○ u ○ s
		Manufacturer				
		Manufacturer's model designation				
		Manufacturer's gear torque capability[1]	(Nm)			
		Application factor[2]				
		Rated gear torque[3]	(Nm)			
		Starting torque ratio[4]				
		Speed ratio input/output				
		Maximum continuous speed of input shaft	(r/min)			
		Direction of rotation of input shaft[5]		☐ cw ☐ acw	☐ cw ☐ acw	☐ cw ☐ acw
		Direction of rotation of output shaft[5]		☐ cw ☐ acw	☐ cw ☐ acw	☐ cw ☐ acw
		Inertia related to input shaft[6]	($kg \cdot m^2$)			
		Power loss at normal operating load	(kW)			
		Maximum permissible thrust bearing load	(N)			
		Type of design: single (s) or double (d) helical		☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		Shaft sealing type				
		Bearings: journal (j) or rolling elements (r.el.)		☐ j ☐ r.el.	☐ j ☐ r.el.	☐ j ☐ r.el.
		Lubrication system: splash (spl.) or pressure (press.) system		☐ spl. ☐ press.	☐ spl. ☐ press.	☐ spl. ☐ press.
		Lubricant kinematic viscosity at 50 °C	(mm^2/s)			
		Lubricant volume (if self-contained system)	(litre)			
		Lubricant consumption of gear	(litre/min)			
		Lubricant inlet effective pressure	(MPa)			
		Integral lubricant pump		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Flow rate at 100 % speed	(litre/min)			
		Separately driven lubricant pump		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Lubricant pump power at 100 % speed	(kW)			
		Lubricant oil from (turbine driver)				
		Lubricant cooler		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		single (s) or duplex (d) type		☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		coolant flow rate	(litre/min)			
		Lubricant filter		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		single (s) or duplex (d) type		☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		filtration rating	(μm)			
		Lubricant heater ☐ electrical ☐ steam		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Heater: voltage/current/power		/ /	/ /	/ /
		Gear mass	(kg)			
		Baseplate, foundation bolts, see data sheet 6				

[1] Torque indicated by manufacturer as design value in his documentation.

[2] See Clause 9.11

[3] Highest torque required at any specified operating point of compressor.

[4] Ratio of starting torque to rated gear torque.

[5] Clockwise (cw) or anticlockwise (acw) when looking from driving towards driven end of respective coupling.

[6] Approximate figure for electric drive only, inertia defined as the mass times the radius of gyration squared.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision | Info.

COMPRESSOR DATA SHEET No. 17

ELECTRIC MOTOR FOR COMPRESSOR DRIVE — Page of

USER:	**PROJECT:**	**SUPPLIER:**
Ref. No.	Ref. No.	Ref. No.

Furnisher ○ USER ○ SUPPLIER

Manufacturer:

Manufacturer's model designation:

Type of motor ☐ synchronous ☐ induction ☐ squirrel cage

☐ wound motor ☐ other

MOTOR CHARACTERISTICS

Voltage = V; Phases = ; Frequency = Hz; Fault level = MVA

Rated driver power: kW (full load)

Speed: at full load = r/min; at 3/4 load = r/min; at 1/2 load = r/min

Efficiency: at full load = %; at 3/4 load = %; at 1/2 load = %

Power factor: at full load = %; at 3/4 load = %; at 1/2 load = %

Full-load current[1] = A; Locked rotor current = % of full-load current[1]

Full-load torque = Nm; Locked rotor torque = % of full-load torque

Starting torque: % of full-load torque

Torque fluctuation during start-up: ± % of full-load torque

Starting procedure ☐ direct on line ☐ ⅄ — △ ☐ other:

Reduced voltage starting: % of full-line voltage

Phase connection ☐ ⅄ ☐ ⋀ Number of terminals:

External excitation: V; kW

Insulation class = ; Maximum temperature = °C

Coolant = ; Flow rate = m^3/s; Inlet temperature = °C

Type of enclosure:

Explosion-proof design ☐ yes ☐ no

Class = ; Pressurizing with =

Bearing type ☐ journal ☐ rolling elements number of bearings:

Thrust bearing ☐ yes ☐ no

Maximum permissible axial end float of rotor: ± mm

Direction of rotation ☐ clockwise ☐ anticlockwise, when looking at the coupling

Lubrication ☐ self-contained ☐ Lubricant:

☐ bearing inlet effective pressure = bar; flow rate = litre/min

Space heater ☐ yes (W; V; phase) ☐ no

Winding temperature detectors ☐ yes (No. ; Ω; at °C)

☐ no

Rotor inertia[2]: $kg \cdot m^2$

☐ baseplate ☐ slide rails ☐ mounting pads (see data sheet 8)

Motor mass: kg

Maximum lifting capacity — for erection: kg

— for maintenance: kg

Applicable standards (see data sheets 7 and 8):

Motor testing:

---

[1] At the lower limit of the nominal voltage range.

[2] Inertia defined as the mass times the radius of gyration squared.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
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Date										

RECIPROCATING COMPRESSOR DATA SHEET No. 18

Re-vision	Info.	PIPEWORK		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

PIPEWORK

Re-vision	Info.	Item 1)	Pipework material 2)	Flange requirements 2) (e.g. facing, rating)	Low point drains 3)		Fur-nisher 1)		Prefabri-cation (extent of) 4)				Mating flanges 1)	
					T	W	U	S	1	2	3	4	U	S
		Process gas					○	○					○	○
							○	○					○	○
							○	○					○	○
							○	○					○	○
		Coolant					○	○					○	○
							○	○					○	○
		Lubricant					○	○					○	○
							○	○					○	○
		Drain					○	○					○	○
		Vent					○	○					○	○
		Purge					○	○					○	○
		Compressed air					○	○					○	○
		Instrument air					○	○					○	○
		Control fluid					○	○					○	○
		Purge medium					○	○					○	○
		Steam					○	○					○	○
							○	○					○	○
							○	○					○	○
							○	○					○	○
							○	○					○	○
							○	○					○	○
		SUPPORTS												
		— for process gas pipework					○	○						
		— for auxiliary pipework					○	○						
		Foundation bolts for supports					○	○						

Inspection and quality control (see data sheet 30):

1) For limits of supply, refer to the pertinent schematic diagrams.

2) For applicable standards and prohibited sizes, rating, materials, refer to data sheet 7.

3) T, valved; W, plugged.

4) 1, completely fabricated; 2, partially fabricated (mixture 1 + 3); 3, prefabricated, with closing lengths for site matching; 4, straight tube lengths, bends and fittings.

For inspection and quality control, see data sheet 30.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 19		
		GAS COOLERS		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

		COOLANT ☐ water (see data sheet 5) ☐ air ☐ other				
		Compressor stage				aftercooler
		Cooler designation				
		Location				
		Cooler required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Cooler type (e.g. shell plus tube, finned tubes,				
		double pipe etc.)				
		Removable bundle	☐	☐	☐	☐
		Gas through the tubes	☐	☐	☐	☐
		Thermostatic control of coolant flow	☐	☐	☐	☐
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Design conditions				
		— heat load (kW)				
		— gas inlet temperature (°C)				
		— gas discharge temperature (°C)				
		— gas mass rate of flow (kg/s)				
		— gas inlet absolute pressure (MPa)				
		— gas pressure drop (MPa)				
		— gas-side fouling factor ($m^2 \cdot K/W$)				
		— coolant inlet temperature (°C)				
		— coolant temperature rise (K)				
		— coolant mass rate of flow (kg/s)				
		— coolant pressure drop (MPa)				
		— coolant-side fouling factor ($m^2 \cdot K/W$)				
		Mechanical design				
		gas side — design effective pressure (MPa)				
		— design temperature (°C)				
		coolant side — design effective pressure (MPa)				
		tubes — inner diameter × wall thickness (mm)	×	×	×	×
		Materials — shell				
		— tubes				
		— fins				
		— tube plates				
		— baffles				
		— heads				
		Corrosion protection — gas side by				
		— coolant side by				
		Mass of cooler				
		— empty (dry) (kg)				
		— with coolant (wet) (kg)				
		Foundation bolts — furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Cooler integral to compressor	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Applicable specifications (see data sheet 7):				
		Inspection and quality control (see data sheet 30).				
		USER to mark X in Info. column where data required in SUPPLIER's proposal				

		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.			
		COMPRESSOR DATA SHEET No. 20		
		SEPARATORS AND DRAINAGE		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Re-vision	Info.						
		SEPARATORS					
		Compressor stage					
		Separator designation					
		Location					
		Separator required		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher		○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Separator type (centrifugal, impingement etc.)					
		Separator integral to cooler					
		Design conditions					
		— inlet absolute pressure	(MPa)				
		— inlet temperature	(°C)				
		— pressure drop	(MPa)				
		— calculated separated liquid	(litre/h)				
		— design effective pressure	(MPa)				
		— design temperature	(°C)				
		— liquid storage volume	(litre)				
		Material — vessel					
		— internals					
		Corrosion allowance	(mm)				
		Mass of separator	(kg)				
		DRAINAGE					
		Vessel designation (e.g. cooler, separator)					
		Location					
		Drainage required		☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher		○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
		Drainage type (valve, trap)					
		Operation — manual		☐	☐	☐	☐
		— automatic continuous		☐	☐	☐	☐
		— automatic periodic		☐	☐	☐	☐
		Absolute back pressure	(MPa)				
		Materials — body					
		— internals					
		Applicable specifications (see data sheet 7):					
		Inspection and quality control (see data sheet 30):					
		USER to mark X in Info. column where data required in SUPPLIER's proposal					

		Revision No.	Original	1	2	3	4	5	6	7	8	9
		Name										
		Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 21	
		PULSATION DAMPERS, PRESSURE VESSELS	Page of

USER:	**PROJECT:**	**SUPPLIER:**
Ref. No.	Ref. No.	Ref. No.

PULSATION DAMPERS						
Compressor stage						
Damper designation						
— inlet (i) or discharge (d)	☐ i ☐ d	☐ i ☐ d	☐ i ☐ d	☐ i ☐ d	☐ i ☐ d	☐ i ☐ d
Location (reference letter of data sheet 10)						
Damper required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
Furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
Damper type (e.g. volume bottle, snubber etc.)						
Design						
Inlet absolute pressure (MPa)						
Pulse level	X/Y/Z	X/Y/Z	X/Y/Z	X/Y/Z	X/Y/Z	X/Y/Z
Pressure drop (%)						
Design effective pressure (MPa)						
Design temperature (°C)						
Volume (litre)						
Materials — vessel						
— internals						
Corrosion allowance (mm)						
Mass of damper (kg)						

SYSTEM PULSATION ANALYSIS ☐ yes ☐ no

Furnisher ○ USER ○ SUPPLIER ○ other

from: to:

from: to:

PRESSURE VESSELS (other than coolers, separators, dampers, silencers, filters)			
Vessel designation			
Function			
Location (reference letter of data sheet 10)			
Furnisher	○ U ○ S	○ U ○ S	○ U ○ S
Design effective pressure (MPa)			
Design temperature (°C)			
Volume (litre)			
Materials — vessel			
Corrosion allowance (mm)			
Mass of vessel (kg)			

Applicable specifications (see data sheet 7):

Inspection and quality control (see data sheet 30):

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.				
		COMPRESSOR DATA SHEET No. 22			
		SILENCERS AND GAS FILTERS	Page of		
		USER:	**PROJECT:**	**SUPPLIER:**	
		Ref. No.	Ref. No.	Ref. No.	
		SILENCERS			
		Silencer designation			
		Location (reference letter of data sheet 10)			
		Silencer required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer			
		Silencer type (e.g. resonance, absorption etc.)			
		Attenuation [dB(A) re 10^{-12} W]			
		Inlet absolute pressure (MPa)			
		Pressure drop (kPa)			
		Silencer for installation without sound isolation	☐	☐	☐
		Silencer complete with sound isolation	☐	☐	☐
		Design effective pressure (MPa)			
		Design temperature (°C)			
		Materials — vessel			
		— internals			
		Corrosion allowance (mm)			
		Mass of silencer (kg)			
		GAS FILTERS			
		Filter designation			
		Location (reference letter of data sheet 10)			
		Filter required	☐ yes ☐ no	☐ yes ☐ no	☐ yes ☐ no
		Furnisher	○ U ○ S	○ U ○ S	○ U ○ S
		Manufacturer			
		Filter type (e.g. paper, dry fabric etc.)			
		Single (s) or duplex (d)	☐ s ☐ d	☐ s ☐ d	☐ s ☐ d
		Manually operated			
		Automatically operated			
		Mesh size (μm)			
		Inlet absolute pressure (MPa)			
		Clean pressure drop (at normal operating point) (kPa)			
		Maximum pressure drop (kPa)			
		Design effective pressure (MPa)			
		Design temperature (°C)			
		Materials — vessel			
		— internals			
		Corrosion allowance (mm)			
		Mass of filter (kg)			
		Applicable specifications (see data sheets 7 and 8):			
		Inspection and quality control (see data sheet 30):			
		USER to mark X in Info. column where data required in SUPPLIER's proposal			

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 23		
		VALVES		Page of
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Valve function	Item designation	Location (reference letter of data sheet 10)	Size	Rating	Materials		Furnisher	
			DN	PN	Body	Trim		
			mm	MPa			U	S
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
							○	○
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							○	○
							○	○

Applicable standards and prohibited sizes, rating, materials (see data sheet 7):

Inspection and quality control (see data sheet 30):

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision			
	RECIPROCATING COMPRESSOR DATA SHEET No. 24		
	LUBRICATION SYSTEMS	Page of	
	USER:	**PROJECT:**	**SUPPLIER:**
	Ref. No.	Ref. No.	Ref. No.

		Furnisher	
MOTION WORK LUBRICATION			
Lubricant type:		U	S
Lubricant kinematic viscosity: at °C = mm^2/s			
First charge of lubricant: litre		○	○
Lubricant	☐ in crankcase		
Normal operating effective pressure: MPa			
Flow rate from pump at normal pressure and temperature: litre/min			
Lubricant pump	☐ shaft driven: type = ; flow rate = litre/min	○	○
	☐ separately driven: type = ; flow rate = litre/min	○	○
	☐ standby: type = ; flow rate = litre/min	○	○
	☐ electrical motor for lubricant pump: power = kW; V	○	○
	☐ hand-priming pump: type =	○	○
Filter	☐ single ☐ duplex; type:	○	○
	mesh size: µm		
Lubricant cooler	☐ no lubricant cooler		
	☐ single ☐ duplex; type:	○	○
	coolant:		
	inlet temperature: normal = °C; max. = °C; min. = °C		
	temperature rise = K; flow rate = litre/min		
	☐ in the tubes ☐ around the tubes		
	materials:		
	waterside corrosion allowance: mm		
Lubricant heater	☐ no lubricant heater		
	☐ electrical: power = kW; V	○	○
	☐ steam: maximum effective pressure = MPa	○	○
	location:		
CYLINDER LUBRICATION			
Lubricant type =	; consumption = g/h		
Lubricant kinematic viscosity at °C = mm^2/s			
☐ lubricator:	type = ; number of lubrication points =	○	○
	☐ shaft driven ☐ separately driven; priming by =		
	☐ electrical motor for lubricator: power = kW; V		
☐ additional cylinder lubrication tank: location =	; volume = litre	○	○
Cylinder lubricant heater	☐ no cylinder lubricant heater		
	☐ electric: power = kW; V	○	○
	☐ steam: maximum efective pressure = MPa	○	○
	location:		

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 25	
		CONTROLS AND INSTRUMENTATION (general)	Page of

USER:	PROJECT:	SUPPLIER:
Ref. No.	Ref. No.	Ref. No.

			Furnisher	
			U	S
Start-up mode	☐ manual	☐ automatic		
Operation	☐ local	☐ remote		
	☐ from control room			
Local compressor panel	☐ yes	☐ no	○	○
space for USER's instruments required	☐ yes	☐ no		
Local driver panel	☐ yes	☐ no	○	○
space for USER's instruments required	☐ yes	☐ no		
Control room panel	☐ yes	☐ no	○	○
remote monitoring signal of controlled condition	☐ yes	☐ no		
space for USER's instruments required	☐ yes	☐ no		
Electrical interlock system				
	☐ in local panel		○	○
	☐ in control room		○	○
	☐ in relay room		○	○
Alarm indicators	☐ in local panel	☐ in control room		
Trip functions	☐ with sequence indication	☐ without sequence indication		
External electrical wiring			○	○
External instrument piping			○	○

Panel requirements (for explosive gas atmosphere see data sheet 4)

☐ open ☐ fully enclosed ☐ weather proof

☐ pressurized with:

Primary sensing switch contacts shall

☐ open ☐ close to actuate alarm

☐ open ☐ close to initiate trip

Solenoids ☐ normally energized ☐ de-energized

Language of panel labelling:

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.						
		RECIPROCATING COMPRESSOR DATA SHEET No. 26					
		CONTROLS		Page of			
		USER:	**PROJECT:**	**SUPPLIER:**			
		Ref. No.	Ref. No.	Ref. No.			

Re-vision	Info.			Start unloading	Flow rate control	Furnisher	
						U	S
		Unloaded start	☐ required				
		Flow rate control	☐ required				
		Control range					
		— full load down to			%		
		— infinitely variable to			%		
		— steps: number for step control					
		Method					
		— suction valves depressors		☐	☐		
		— clearance pockets: fixed volume			☐		
		— clearance pocket: variable volume			☐		
		— overall bypass		☐	☐	○	○
		— first stage bypass		☐	☐	○	○
		— suction throttling		☐	☐	○	○
		— variable speed			☐		
		Actuators operation					
		— manual		☐	☐		
		— pneumatic: minimum effective pressure =	MPa	☐	☐		
		— by process gas from =	stage	☐	☐		
		— hydraulic: pressure from =		☐	☐		
		— electrical		☐	☐		
		Actuators control					
		— machine mounted		☐	☐		
		— remote		☐	☐	○	○
		— automatic		☐	☐	○	○
		Signal (for automatic operation)					
		— electrical[1]		☐	☐		
		— pneumatic[1]		☐	☐		
		Signal source (for automatic operation)					
		— inlet pressure		☐	☐		
		— interstage pressure		☐	☐		
		— discharge pressure		☐	☐		
		— other:		☐	☐		
		Regulator					
		— type:	electric		☐	○	○
		— manufacturer:	pneumatic		☐	○	○
		[1] Signal range:					
		USER to mark X in Info. column where data required in SUPPLIER's proposal					

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

RECIPROCATING COMPRESSOR DATA SHEET No. 27

INSTRUMENTATION 1 (compressor)

Page of

USER:	PROJECT:	SUPPLIER:
Ref. No.	Ref. No.	Ref. No.

Re-vision	Info.	INSTRUMENTATION FOR COMPRESSOR		Indicators								Switches											
				Mounting alternatives 1)													Function 2)		Signal transfer				
				local	local panel	control room	connection only		recorder local	recorder control room		local	local panel	control room	connection only		alarm	trip	electric	pneumatic	transmitter		
		Units for dials																					
		— pressure:																					
		— temperature:																					
		— flow rate																					
		GAS																					
		Compressor inlet — pressure																					
		— temperature																					
		Cylinder inlet — pressure																					
		— temperature																					
		Cylinder outlet — pressure																					
		— temperature																					
		Aftercooler outlet — temperature																					
		Separators — liquid level																					
		LUBRICANT																					
		Sump motion work — level																					
		— temperature																					
		Filter inlet — pressure																					
		Filter pressure drop — pressure																					
		Cooler inlet — temperature																					
		Cooler outlet — pressure																					
		— temperature																					
		Cylinder — flow rate																					
		Lubricator tank — level																					
		COOLANT																					
		Inlet — pressure																					
		— temperature																					
		Cylinder — flow rate																					
		Cylinder outlet — temperature																					
		Gas cooler — flow rate																					
		Gas cooler outlet — temperature																					
		Pressure packing — flow rate																					
		Pressure packing outlet — temperature																					
		MOTION WORK																					
		Main bearings — temperature																					
		Tachometer																					
		Hour meter																					

1) Mark U or S for USER's or SUPPLIER's supply.

2) Mark Hi or Lo for alarm and trip functions.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

1	Re-vision	Info.	**RECIPROCATING COMPRESSOR DATA SHEET No. 28**		
2			INSTRUMENTATION 2 (auxiliaries)		Page of
3			**USER :**	**PROJECT:**	**SUPPLIER :**
4					
5					
6			Ref. No.	Ref. No.	Ref. No.
7					

08			**INSTRUMENTATION FOR AUXILIARIES**		Indicators								Switches											
9																								
10			Units for dials		Mounting alternatives 1)													Function 2)		Signal transfer				
11			— pressure :																					
12			— temperature :																					
13			— flow rate :																					
14																								
15																								
16					local	local panel	control room	connection only		recorder local	recorder control room		local	local panel	control room	connection only		alarm	trip	electric	pneumatic	transmitter		
17			UTILITIES																					
18			Instrument air — pressure																					
19			Control fluid — pressure																					
20			Purge gas — pressure																					
21			Vent line — pressure																					
22			— flow rate																					
23			Steam — pressure																					
24			— temperature																					
25																								
26			ELECTROMOTOR																					
27			Windings — temperature																					
28			Bearings — temperature																					
29			Voltage (V)																					
30			Current (A)																					
31			Power (W)																					
32			cos φ																					
33																								
34			GEAR LUBRICATION																					
35			Filter inlet — pressure																					
36			Cooler inlet — temperature																					
37			Cooler outlet — pressure																					
38			— temperature																					
39			Oil sump — temperature																					
40			— level																					
41																								

42													
43													
44													
45													
46													
47													
48													
49													
50													
51													
52			1) Mark U or S for USER's or SUPPLIER's supply.										
53			2) Mark Hi or Lo for alarm and trip functions.										
54			USER to mark X in Info. column where data required in SUPPLIER's proposal										
55			Revision No.	Original	1	2	3	4	5	6	7	8	9
56			Name										
57			Date										

Re-vision | Info.

RECIPROCATING COMPRESSOR DATA SHEET No. 29

INSPECTION AND QUALITY CONTROL 1 (compressor) | Page of

USER :	**PROJECT :**	**SUPPLIER :**
Ref. No.	Ref. No.	Ref. No.

MATERIAL CERTIFICATES

Item	Material to SUPPLIER's specifications with				
			Certificate based on individual tests of each item by		
	No certificate	Manufacturer's certificate	Recognized authority	Manufacturer's or SUPPLIER's inspector	Representative of USER
Crankcase 1)					
Crankshaft 1)					
Connecting rods 1)					
Cylinders :					
stages 1)					
stages					
Piston rods 1)					

Inspection authority:

PRESSURE TESTS

witnessed by:

Cylinder number (cf. schematic diagram on data sheet 11)							
Hydrostatic test							
– witnessed		☐	☐	☐	☐	☐	☐
– gas side : test effective pressure	(MPa)						
– coolant side : test effective pressure	(MPa)						
Gas sealing test							
– required		☐	☐	☐	☐	☐	☐
– witnessed		☐	☐	☐	☐	☐	☐
– medium							
– gas side : test effective pressure	(MPa)						
– coolant side : test effective pressure	(MPa)						

Crankcase ☐ pressure test required ☐ sealing test required

Description:

1) In the case of stocked items, typical reports will be furnished.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 30		
		INSPECTION AND QUALITY CONTROL 2 (pipework, vessels)		Page of
		USER :	**PROJECT :**	**SUPPLIER :**
		Ref. No.	Ref. No.	Ref. No.

PIPEWORK

Material certificates :

Mechanical properties (M) and/or chemical analysis (C) required for 1)	Material to SUPPLIER's specifications with									
					Certificate based on individual tests of each item by					
	No certificate		Manufacturer's certificate		Recognized authority		Manufacturer's or SUPPLIER's inspector		Representative of USER	
	M	C	M	C	M	C	M	C	M	C

Inspection authority :				
Hydrostatic tests			Furnisher	
☐ in workshop	☐ witnessed by :		U	S
☐ on site	☐ witnessed by :		○	○
required for 1) :				
Weld tests				
☐ in workshop	inspection authority :		○	○
☐ on site	inspection authority :		○	○
☐ radiograph	☐ partial inspection 1)	☐ 100 % inspection		
☐ ultrasonic	☐ partial inspection 1)	☐ 100 % inspection		
required for 2) :				
Gas sealing tests :	; medium =			
☐ in workshop	☐ witnessed by :			
☐ on site	☐ witnessed by :		○	○
required for 2) :				
PRESSURE VESSELS (coolers, separators, dampers etc.)				
Material certificates, hydrostatic tests and welds tests according to the requirements of the specified standards and codes (see data sheet 7) :				
Inspection authority :				
Gas sealing tests :	; medium =			
☐ in workshop	☐ witnessed by :			
☐ on site	☐ witnessed by :		○	○
required for 2) :				

1) Level of partial inspection to be defined by the USER.

2) For example, vessel or piping designation, fluid, pressure level, materials etc.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision | Info.

RECIPROCATING COMPRESSOR DATA SHEET No. 31

COMPRESSOR AND DRIVER TESTS

Page of

USER:	**PROJECT:**	**SUPPLIER:**
Ref. No.	Ref. No.	Ref. No.

			Furnisher	
Compressor running test			U	S
☐ barring over only				
running at no load	☐ in workshop	☐ witnessed		
	☐ on site	☐ witnessed	○	○
load running by simulation	☐ in workshop	☐ witnessed		
	☐ on site	☐ witnessed	○	○
witnessed by:				
Compressor performance acceptance test				
according to code (see data sheet 7):				
☐ workshop: driver =		☐ witnessed		
gas =				
witnessed by:				
☐ on site: gas =		☐ witnessed	○	○
made by:				
measuring instruments, specially for test:			○	○
witnessed by:				
Main driver test				
☐ running at no load in workshop		☐ witnessed		
acceptance test, running at load	☐ in workshop	☐ witnessed		
	☐ on site	☐ witnessed	○	○
according to code (see data sheet 7):				
made by:				
measuring instruments, specially for test:			○	○
witnessed by:				
Gear test				
☐ running at no load in workshop		☐ witnessed		
running at load	☐ in workshop	☐ witnessed		
	☐ on site	☐ witnessed	○	○
☐ acceptance test				
according to code (see data sheet 7):				
made by:				
measuring instruments, specially for test:			○	○
witnessed by:				
Noise measurement	☐ on site	☐ witnessed	○	○
according to code (see data sheet 8):				
made by:				
witnessed by:				

USER to mark X in Info. column where data required in SUPPLIER'S proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

Re-vision	Info.	COMPRESSOR DATA SHEET No. 32

SHIPMENT AND PRESERVATION

Page of

USER:

Ref. No.

PROJECT:

Ref. No.

SUPPLIER:

Ref. No.

PAINTING

	Compressor	Driver	Auxiliaries	Pipework
Primer — ex. works by SUPPLIER	☐	☐	☐	☐
Final painting [1] — colour				
— ex. works by SUPPLIER	☐	☐	☐	☐
— on site by USER	☐	☐	☐	☐

PACKING

☐ unpackaged ☐ seaworthy packing ☐ tropical protection

☐ landpacking: ☐ road ☐ rail

Heaviest part for shipment: ; mass = kg

Package dimensions: length = m; width = m; height = m

Storage on site: ; maximum duration = months

☐ Rust preventatives: ○ by USER ○ by SUPPLIER

☐ packed as shipped ☐ unpacked

☐ indoors, heated ☐ indoors, unheated

☐ outdoors, with roof ☐ outdoors, without roof

Storage responsibility ○ USER ○ SUPPLIER

[1] USER to specify special paint manufacturer.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
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COMPRESSOR DATA SHEET No. 33

DOCUMENTATION

Page of

Re-vision	Info.			
		USER:	**PROJECT:**	**SUPPLIER:**
		Ref. No.	Ref. No.	Ref. No.

Re-vision	Info.	Document	Furnisher		Preliminary document			Document for approval				Final document			Identification number
			USER	SUPPLIER	Number of copies		Date	Number of copies		Date		Number of copies		Date	
					Paper copy	Transparency		Paper copy	Transparency	1st submitted	Approved	Paper copy	Transparency		
		Schematics	○	○											
		– lubrication system	○	○											
		– cooling system	○	○											
		– control and instrumentation	○	○											
		– steam system	○	○											
		– process gas system	○	○											
		Diagrams	○	○											
		– electrical functional	○	○											
		Drawings	○	○											
		– compressor outline	○	○											
		– driver outline	○	○											
		– main auxiliaries outline	○	○											
		– coupling	○	○											
		– compressor sectional [1]	○	○											
		– pressure vessel	○	○											
		– foundation	○	○											
		Curves	○	○											
		– compressor performance	○	○											
		– compressor starting torque	○	○											
		– motor torque/speed	○	○											
		Pulsation analysis	○	○											
		List of instruments	○	○											
		Instrument and control terminal													
		interconnection identification	○	○											
		Instruction manual	○	○											
		Lubricant specification	○	○											
		Performance test certificate	○	○											
		Spare parts list	○	○											
		Manufacturing schedule	○	○											
			○	○											
			○	○											
			○	○											
			○	○											

Languages:

---

[1] If not part of instruction manual.

USER to mark X in Info. column where data required in SUPPLIER's proposal

Revision No.	Original	1	2	3	4	5	6	7	8	9
Name										
Date										

1	Reference data sheet	**RECIPROCATING COMPRESSOR SHORT-FORM DATA SHEET No. 34**						1
2		**USER:**	**PROJECT:**		**SUPPLIER:**			2
3								3
4		Ref. No.	Ref. No.		Ref. No.			4
5	3	**Installation:** country =	; ☐ **indoors** ☐ **outdoors**					5
6	1	**Number of units for service** =	; **Number of standby units** =					6
7	2	**Gas composition:**	mol. %					7
8								8
9	1	Operating point:						9
10	2	**Gas molar mass**	(kg/kmol)					10
11	2	**Relative water vapour pressure**	(%)					11
12	1	**Mass flow rate**	(kg/h)					12
13	1	**Inlet absolute pressure**	(MPa)					13
14	1	**Inlet temperature**	(°C)					14
15	1	**Discharge absolute pressure**	(MPa)					15
16	26	**Flow rate control down to**	(%)					16
17	12	**Oil-free compressor required**	☐					17
18	12	**Two compressor distance pieces required**	☐					18
19	5	**Cooling water inlet temperature**	(°C)					19
20	5	**Cooling water type:** ☐ town ☐ cooling tower ☐ river ☐ brackish						20
21		☐ sea ☐ other						21
22	1	DRIVER — furnisher ○ U ○ S						22
23	1	— type: ☐ electric motor ☐ steam turbine ☐ gas turbine ☐ diesel engine ☐ gas engine ☐ other						23
24	4	— power: V; Hz; phase =						24
25	7	Pressure vessel code:						25
26	30	Inspection authority:						26
27	4	Electrical area classification:						27
28	7	Limitations (e.g. speed, temperature, leakage, noise):						28
29	8							29
30								30
31	11	COMPRESSOR — model designation:						31
32	11	Machine type ☐ vertical ☐ V-type ☐ W-type						32
33	11	☐ horizontal opposed ☐ horizontal ☐ L-type						33
34	11	Number of crankthrows:						34
35	12	Cylinder number or stage						35
36	12	Cylinder diameter	(mm)					36
37	12	Piston stroke	(mm)					37
38	12	Single acting		☐	☐	☐	☐	38
39	12	Double acting		☐	☐	☐	☐	39
40	12	Actual rod load	(kN)					40
41	12	Allowable rod load	(kN)					41
42								42
43	11	Compressor shaft speed:	r/min					43
44	1	Compressor required power:	kW					44
45	1	Recommended drive power:	kW					45
46	5	Cooling water flow rate:	litre/s					46
47								47
48	16	TRANSMISSION GEAR: furnisher ○ U ○ S						48
49	14	Couplings with guards: type ☐ rigid ☐ flexible						49
50	15	Belt drive complete with fly-wheel, belts, pulley and guard						50
51	15	Barring device ☐ manual ☐ electric						51
52	6	Common baseplate for:						52
53	6							53
54	6	Foundation bolts — furnisher ○ U ○ S						54

55		Revision No.	Original	1	2	3	4	5	6	7	8	9	55
56		Name											56
57		Date											57

	RECIPROCATING COMPRESSOR SHORT-FORM DATA SHEET No. 35				
Reference data sheet	**USER:**	**PROJECT:**	**SUPPLIER:**		
	Ref. No.	Ref. No.	Ref. No.		
11		Compressor schematic			
13	CYLINDER MATERIALS				
13	Cylinder number				
13	Cylinder				
13	Liner				
13	Piston rings				
13	Piston rod				
13	Packing elements				
13	Valve body				
24	MOTION WORK LUBRICATION ☐ yes/no				
24	Lubricant	☐ in crankcase	☐ in separate reservoir		
24	Lubricant pump	☐ crankshaft driven	☐ separately driven		
24	Standby pump	☐ hand operated	☐ separately driven		
24	Oil cooler	☐ single	☐ duplex		
24	Oil filter	☐ single	☐ duplex		
24	Oil heater	☐ electrical	☐ steam		
	PRESSURE VESSELS				
	Stage No.				
19	Gas cooler after stage: furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
19	type				
19	removable bundle	☐	☐	☐	☐
20	Separator after stage: furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
20	automatic drainage	☐	☐	☐	☐
21	Pulsation damper before stage: furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
21	Pulsation damper after stage: furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
21	pulse level X, Y or Z				
22	Gas filter before stage: furnisher	○ U ○ S	○ U ○ S	○ U ○ S	○ U ○ S
22					
23	VALVES of SUPPLIER's supply				
23	Relief valves for each stage	☐ yes/no	☐ non-return valve		
23	Terminal valves:	☐ for process gas	☐ for cooling water		
26	START UNLOADING CAPACITY CONTROL				
26	Valve lifting	☐ yes/no	by-pass ○ U ○ S		
26	Flow rate control	☐ manual	☐ automatic		
27	INSTRUMENTATION				
27	☐ connection only	☐ local	☐ local panel	☐ control room	
27	MASS of SUPPLIER's supply				
11	Compressor:	kg			
17	Driver:	kg			
22	Pressure vessels and pipework:	kg			

	Revision No.	Original	1	2	3	4	5	6	7	8	9
	Name										
	Date										

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Doc No. HMD 22 (4725)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

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